NNI

4.0 Presentation

- 4.1 Introduction
 - 4.1.1 Cover instrumentation block diagrams for RCS & secondary systems
 - 4.1.2 Particulars of ICS inputs
- 4.2 RCS Temperatures
 - 4.2.1 Locations (figure 11.1-1)

note: RPS and NNI NOT shared!

4.2.2 T_h (figure 11.1-2)

signal sources:

NNI RTD & bridge ECI RTD & bridge

note: optical isolator

outputs:

non-selected to plant computer NR indication (530F - 650F) flow temperature compensation input to Loop Tave input to ΔT calculation input to Unit T_h input to Unit Tave input to ICS BTU calculation high temperature alarm (635F)

4.2.3 Wide Range T_C (figure 11.1-3)

signal sources:

NNI RTD & bridge ECI RTD & bridge

outputs:

non-selected to plant computer WR indication (50F - 650F) RCP start interlock (500F)

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4.2.4 Narrow Range T<sub>C</sub> (figure 11.1-4)
             signal sources:
                    NNI RTD & bridge
                    ECI RTD & bridge
              outputs:
                    plant computer
                    NR indication (530F - 650F)
                    input to Loop \Delta T calculation
                     input to Unit Tave
                     input to Loop Tave
                     input to average Loop T_{\text{C}}
                     input to \Delta T_c calculation
                            (Loop A - Loop B)
                           FW demand \Delta T_c control
 4.2.5 △T (figure 11.1-5)
              \Delta T = (T_h - T_c)
              indication (\widetilde{OF} - 80F) ... no control functions
               sources: Loop A & Loop B
              Unit \Delta T = (Unit T_h - Unit T_c)
 4.2.6 Tave
               Tave = (T_h + T_c) / 2
               sources:
                      Loop A
                      Loop B
                      Unit Th
                      Unit Tc
               outputs:
                      NR indication (530F - 650F)
                      ICS (reactor demand)
               auto / man selector switch:
                      interlock ... auto selects Loop with
                      highest RCS flow should RCS flow sensed
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4.2.7 Temperature summary (figure 11.1-17)

in a Loop fall below 90%

- 4.3 RCS flow (figure 11.1-6)
 - 4.3.1 Location ... in each hot leg
 - 4.3.2 Detector (figure 11.1-7)

flow tube
high side ... RCP discharge
low side ... static head
advantage ... minimum flow restriction
disadvantage ... unable to measure low flow

outputs: (figure 11.1-8)

indication (0 - 120 x 10⁶ lbm/hr)
Tave auto / man selector switch
ICS ... Unit load demand (load limiter)
ICS ... FW demand (partial flow ops)

- 4.4 Pressurizer level (figure 11.1-9)
 - 4.4.1 Signal sources ... ECI
 - 4.4.2 Outputs:

non-selected to plant computer
high-high level alarm (350")
high level alarm (240")
low level alarm (200")
low-low level alarm & interlock (120")
recorder (0" - 400")
input to makeup control valve

4.4.3 Density compensated

(H_{ref} x D_{ref}) - (H_{var} x D_{var})

 $D_{\mbox{var}}$ is a function of pressurizer temperature

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4.4.4 Level program (figure 11.1-10)
                360" .....
                                      90%
                     expansion on turbine trip
                240" ......
                     insurge margin
                                       level setpoint
                220" .....
                     outsurge margin
                200" .....
                      no HPI
                                      low level tap
                  0" .....
     Pressurizer Pressure (figure 11.1-11)
4.5
     4.5.1 Wide Range
                 Signal sources ... ECI
                 Outputs:
                      non-selected to plant computer
                      recorder (0 psig - 2500 psig)
                      high pressure bypass warning (1920 psig)
     4.5.2 Narrow Range Pressurizer Pressure (figure 11.1-12)
                 Signal sources:
                      NNI-X
                      NNI-Y
                 Alarms:
                       low (2095 psig)
                       high (2295 psig)
                 PORV:
                       open (2295 psig)
                       close (2270 psig)
                 Heaters:
                     Summer vs. setpoint (2195 psig)
                       error controls heaters
                       PI control to SCR
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4.6 Secondary Indications

- 4.6.1 Locations (figure 11.1-13)
- 4.6.2 Main feed flow (figure 11.1-14)

indication (0 - 9 x 10⁶ lbm/hr) plant computer square root extractor variable gain temperature compensation ICS FW demand

4.6.3 Start up feed flow (figure 11.1-14)

indication (0 - 2 x 10⁶ lbm/hr) plant computer square root extractor variable gain temperature compensation ICS FW demand

4.6.4 Feed temperature (figure 11.1-14)

indication (OF - 600F)
plant computer
RTD bridge
supplies temp compensation for FW flow
ICS FW demand (BTU limits)

4.6.5 Feed reg valve dp (figure 11.1-14)

indication (0 psid - 100 psid) plant computer ICS FW demand (MFP speed)

4.6.6 OTSG instrumentation (figure 11.1-15)

Start up level ... ICS input
Full range
Steam temperature ... superheat limits
(removed)

4.7 Smart Analog Signal System (figure 11.1-16)

4.7.1 Purpose

mitigate effects of ICS input failures

4.7.2 Operation

senses degraded input & auto transfers to operable input

two transmitter inputs designated A & B

A & B compared to 3% mismatch

if mismatch ... program determines rate of change of mismatched signal (by comparing with its previous value) ... if rate of change exceeds 30% per second program reiterates to verify failure ... if verified then auto selects operable transmitter and generates alarm